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Electronic Business

FOR MANAGEMENT IN ELECTRONICS, COMPUTER & SYSTEMS COMPANIES — WORLDWIDE

NOVEMBER 27, 1989

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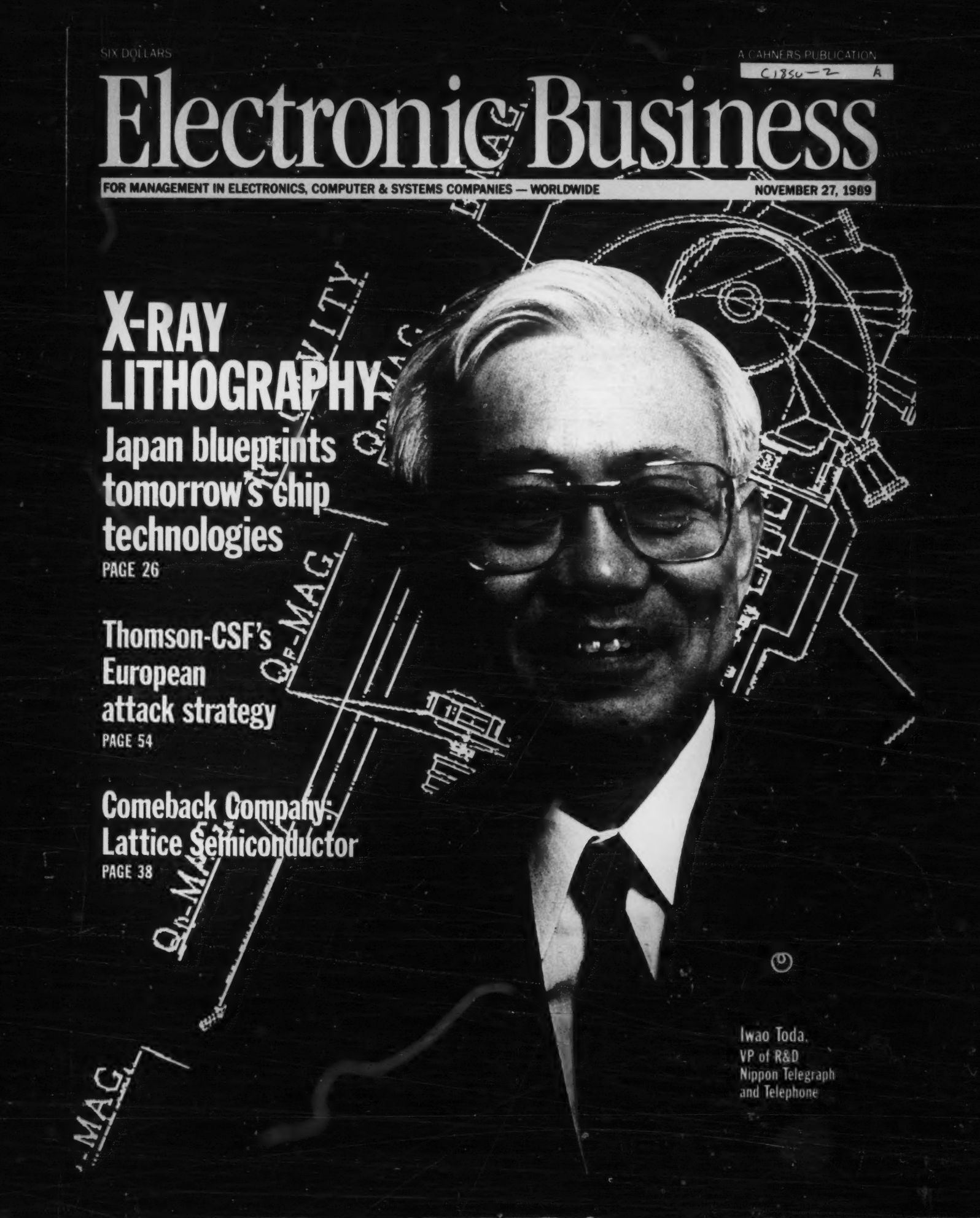

Iwao Toda,
VP of R&D
Nippon Telegraph
and Telephone

Electronic Business

FOR MANAGEMENT IN ELECTRONICS, COMPUTER AND SYSTEMS COMPANIES — WORLDWIDE

VOL. 15, NO. 23 NOVEMBER 27, 1989

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In the battle for dominance of global semiconductor markets, Japan refuses to stand still. The country's five biggest chip makers, led by monopoly telephone company Nippon Telegraph and Telephone, are investing hundreds of millions of dollars in an uncertain technology — synchrotron-based X-ray lithograpy — that could boost density and slash chip manufacturing costs. Meanwhile in the United States, chip makers stand on the sidelines as IBM takes up the challenge alone.

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26 X-ray lithography: Wave of the future?

With the Japanese rushing ahead to commercialize X-ray lithography, many experts believe the U.S. chip industry is at a technological crossroads. U.S. chip makers can boost R&D spending and leap into the X-ray lithography race. Or they can take the short view, hope Japanese efforts are unsuccessful, and suffer the consequences — total loss of the commodity market — if wrong.

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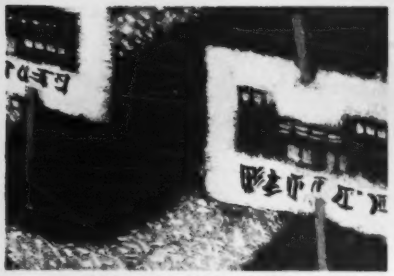
48 Swings of the dollar clip high-tech earnings

The rallying dollar presents a wild card in the financial outlooks of U.S. electronics companies next year. Because many electronics firms generate one-third to one-half of their business abroad, the earnings of their overseas operations are understated when currencies in the host countries decline against the dollar. Some financial observers expect the dollar to continue its rally in 1990.

Cover photograph: Eiji Miyazawa/BlackStar



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With the pending unification of Western Europe in 1992, France's Thomson-CSF is proving that intruders are indeed welcome to control the defense assets in other European nations. The conglomerate has swept through the continent on an unprecedented buying spree, giving it the political, financial and technological clout that undoubtedly will lure more defense contracts its way.

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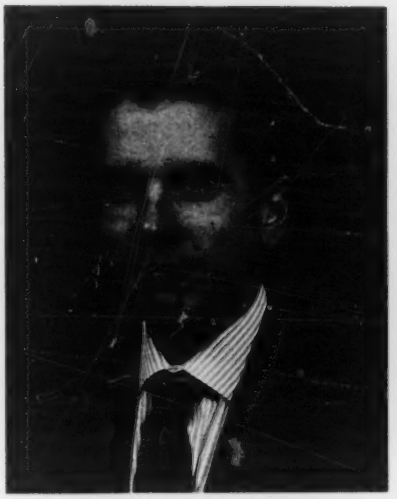
The rush to X-ray

This issue's cover story on Japanese R&D efforts to mass produce chips via synchrotron-based X-ray lithography techniques got me thinking about a television commercial in which a tough auto mechanic, pitching a can of lubricant, ends the spot with the prophetic words: "You can pay me now or pay me later."

The mechanic is telling viewers to spend a few dollars now for the lubricant or spend a lot of dollars later when their car engines seize up. Sure, I'm reaching a bit to make an analogy with X-ray lithography, but, as associate editor Michael Leibowitz underscores in his story, Japan's five biggest chip makers, led by the research might of Nippon Telegraph and Telephone, are rushing to conquer X-ray lithography techniques. Meanwhile, U.S. chip makers, with the exception of IBM and some others, are doing virtually nothing.

Within two DRAM generations, starting about 1996, the Japanese may have the capability to mass produce chips far more cheaply than the United States, which relies on optical lithography. If successful, the Japanese will have an unbridled edge in the race for the future dollars of systems makers.

In researching this story, Mike traveled to Japan and talked with those directly involved in X-ray lithography research efforts. He also chronicled the minimal R&D efforts in the United States. We think his comprehensive article is an important one because the stakes are tremendously high . . . for both the leaders and the laggards.



Michael Leibowitz, associate editor

Comeback company

And the winner is . . .

Each year the editors of ELECTRONIC BUSINESS like to reward the accomplishments of an electronics company that has pulled itself up from the brink of disaster and gone on to prosper. Our choice this year is Lattice Semiconductor.

Senior editor Valerie Rice writes that Lattice, bankrupt in 1987 after being slammed with an $8.5 million loss that year, is making it back to the land of the living — and now actually making money — thanks to strong new leadership and a focused product line.

Speaking of Valerie, this is her final story as an ELECTRONIC BUSINESS staffer. She moves on to the world of daily journalism, covering the semiconductor industry for the *San Jose Mercury News*. Associate editor Mike Leibowitz will replace her in our San Jose bureau. Best wishes to both of them.

MARVIN GREENE, section editor

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Swings of the dollar clip high-tech earnings

As more and more U.S. electronics companies generate large percentages of sales from foreign operations, the rallying dollar figures to further erode overseas profit margins

BY RAY WISE

The outlook for the financial performance of the electronics industry next year contains a wild card: the U.S. dollar, the ascent of which in 1989 clipped the earnings of IBM and other electronics companies. Some observers in the financial community expect the dollar to rally again in 1990.

Many U.S. electronics firms generate one-third to one-half of their business abroad. The reported earnings of their overseas operations are eroded when currencies in the host countries decline against the dollar. Moreover, a strong dollar makes U.S. exports expensive, reducing the global competitiveness of American-made products. Both effects have heightened in high tech in recent years, reflecting an unremitting expansion overseas in the quest for cash flow to fund research and development.

"The dollar's swings are having a greater impact on financial results in technology than ever before," says Robert Natale, vice president of Standard & Poor's Corp. in New York. "IBM derives more than half its revenues overseas. In fact, its revenues in the United States will rise in 1989 for the first time in four years."

The long-term trend of the dollar is up, according to Arnold R. Schmeidler, president of A.R. Schmeidler & Co. Inc., a New York investment management firm. "Foreign investment in the United States keeps the dollar strong, and investors overseas still are underinvested in dollar assets." Schmeidler notes that escalating oil consumption around the world further boosts demand for the U.S. currency. The reason: International oil prices are denominated in dollars.

"I think the dollar has bottomed out," says David Crockett, general partner in 3i Ventures Corp. of Menlo Park, Calif. His comment was made shortly after intervention by the Group of Seven central banks had driven the dollar lower, as part of a concerted effort to cap the currency's appreciation.

Minimal bank intervention

Eventually, not even the central banks of the United States, Japan, Britain, Germany, France, Italy and Canada, acting in concert, can prevail against traders in the $200-billion-a-day foreign exchange market, says Maureen F. Allyn, vice president and chief economist of Scudder, Stevens & Clark Inc., a global investment firm headquartered in New York. "Central bank intervention has very little impact on the foreign exchange market. The sums they inject are too small."

Allyn forecasts a dollar appreciation of 4% to 5% against the Japanese yen and the German mark in the coming months — enough to be felt in the electronics industry.

Says Mark T. Boyer, a portfolio manager for the San Francisco investment firm Volpe, Covington & Welty, "My guess is that a 5% rise in the dollar would cost U.S. electronics companies, overall, about 8% to 9% of their profit growth." About 2% of the setback would reflect currency translation losses on income statements, with another 6% or 7% coming from actual declines in sales volumes and profit margins. When loss of competitiveness trims sales volumes, unit costs go up, driving profit margins lower.

Jonathan Levine

Economist Maureen F. Allyn of Scudder, Stevens & Clark: Forecasts a dollar appreciation of 4% to 5% against the Japanese yen and the German mark

Allyn makes a strong case for a rising dollar, citing improvement in the U.S. trade deficit and in the federal budget deficit, expressed as a percentage of gross national product (GNP). She predicts the merchandise trade deficit will ease from an estimated $116 billion in 1989 to $90 billion next year, and the budget deficit will fall from an estimated 3.2% this year to 2.1% of GNP in 1990.

Moreover, says Allyn, the U.S. Commerce Department discovered a few months ago that such U.S. service exports as consulting services and travel had been understated by $21 billion in 1988. (U.S. goods and services bought by foreign nationals are exports, no matter where the transactions occur.) "This means that there are fewer dollars at large in the world than we originally had thought," Allyn explains.

High interest rates tend to lure capital from abroad, strengthening the home currency, and rates in the United States surpassed those of our trading partners some time ago. Just recently, the gaps began to narrow, but investment analyst Schmeidler predicts that the trend, if it persists, will slow the dollar's ascent rather than throw it into a decline.

Another dollar booster is the ability of U.S. currency to serve as an investment haven in times of crisis, a role traditionally assigned to gold. The dollar rallied last summer, for example, when elements of the French fleet steamed toward war-torn Lebanon, but the price of gold dropped, reports Peter Cavelti, president of Cavelti Capital Management Ltd., Toronto.

The dollar can leave its mark on high-tech income statements directly or indirectly in a kind of ricochet effect. Boeing Co., for example, is a major buyer of high-tech products for its aircraft. If a steadily rising dollar were to depress the aerospace company's exports, the pinch would be passed along to the electronics industry.

Export growth

Not that the impact of a strong dollar on high tech's export growth is easily projected. Currency appreciation, in this context, amounts to price increases. The effect of those increases on sales volumes depends on the strength of demand, and demand for U.S. products remains powerful in Asia and Europe. Japan has switched from an export-driven to a consumer-driven economy with stunning speed, and imports are climbing. In fact, says Henry de Vismes, managing director of London-based Kleinwort Benson International Investment Ltd., "Huge trade surpluses in Japan are a thing of the past."

Germany is another reservoir of demand for U.S. high-tech products. As a reflection of tax cuts and an influx of willing workers from East Germany and elsewhere in Eastern Europe, the German economy is surging. Economic health prevails throughout Western Europe, promising at least to blunt the destructive effects of an escalating dollar. "We are running a trade *surplus* with the European Common Market as a whole," notes John R. Hickling, portfolio manager of the Fidelity International Growth and Income Fund, Boston.

Indicative of a stronger dollar, the U.S. budget deficit and merchandise trade deficit are both forecast to show significant reductions

"Selling U.S. goods abroad these days is not so much a matter of price, but 'Can you ship the product?' " explains Allyn, who figures U.S. export growth will decline in 1990, but not ruinously. She expects nonagricultural exports to increase by 7% next year, compared with an estimated 13% in 1989.

Even within high tech, dollar appreciation affects different companies differently. Hardware and systems makers that buy components abroad, in relative cheap currencies, benefit from an offset in the form of cost reductions. Some high-tech companies build entire end products overseas and, to the extent that they do, are shielded from currency fluctuations. "A lot of people are more balanced than they used to be," says Jim Timmins, principal, Hambrecht & Quist Inc., San Francisco.

But what about IBM, which collects the greater part of its revenue overseas? Did it not benefit from offsetting foreign purchases during the dollar's 1989 climb? "My guess is that they have more costs in the U.S. than some of the other companies. IBM produces a lot of its own stuff," says John W. Ballen, vice president and director of research for Massachusetts Financial Services, Boston.

Investors in Germany, Japan, Taiwan and Britain, who anticipate further gains by the dollar, are likely to accelerate their U.S. investment to get in before the dollar climbs again, and this could be beneficial. Crockett of 3i Ventures looks for a strong inflow from Japanese venture capitalists and investment companies, who usually prefer to work with coinvestors.

Beyond 1990

Looking beyond 1990, some analysts stress that the dollar would be weakened if foreign investment in the United States were to fall significantly. Cavelti says the dollar itself might spur such a scenario. He believes that because commodities trade in dollars, appreciation of the dollar worsens inflation around the world. The ultimate result of this process could be therapeutic interest rate boosts, clearing the way for economic slowdown.

Meanwhile, about 400 traders in London, New York and Tokyo make a market in the world's major currencies, sometimes bucking central banks. Whether currency stability will ever emerge from this titanic confrontation is doubtful. Some argue that central bank intervention serves only to worsen currency volatility.

"It is really trying to be a corporate treasurer in this highly volatile environment," says Allyn of Scudder, Stevens & Clark, "and I don't see us coming to anything like stability." However, she points out, the tenure of President Bush just might provide a respite from sharp, potentially destructive currency movements. □

Buying spree boosts Thomson-CSF's empire

With European governments now willing to let outsiders control their military assets, the French conglomerate is emerging as the leader of a restructured defense electronics industry

BY BARBARA N. BERKMAN

At the Thomson-CSF headquarters in La Defense section of Paris, a cadre of dark-suited men brandishing radio phones guard the vestibule. Positioned there to keep out intruders, they are protecting an aggressive, cross-border intruder into the European defense business.

Thomson-CSF is harvesting a European defense electronics industry that's in a state of budget-tightening upheaval. The French conglomerate recently has swept through the continent on an unprecedented —but unprotested — buying spree, principally in The Netherlands, West Germany and England. The result has made it a broader, more technologically diversified company that now is linked to European governments previously reluctant to let an outsider control their defense assets.

Thomson-CSF is quickly becoming a pan-European company. It now has the political, financial and technological clout that undoubtedly will lure more defense contracts its way in Europe and throughout the rest of the world. U.S. defense manufacturers have recognized Thomson-CSF as a threat and already are aligning with the European giant.

As the worldwide defense market contracts, Thomson-CSF's merger strategy matches that of other European companies — it is a reaction to changing conditions. Costs of developing, manufacturing and marketing sophisticated military systems have escalated and outweigh what shrinking home markets can support. European governments are paring down their defense budgets. Britain and The Netherlands already have opened up their defense assets to foreign investors, and other European governments are expected to follow.

Second-tier defense electronics firms are feeling the pinch most. Many are placing non-core defense assets on the block, because no longer are these profitable niche businesses subsidized by their European governments. The result, predicts Cyril Teed, managing director of England's Plessey Defense Systems Ltd., is that "Some companies are showing real commitment to defense, and others are showing less stomach for the battle ahead."

A window of opportunity is opening in Europe, but U.S. defense firms aren't sure what to do. Left cash-poor by the shrinking U.S. defense budget, they're reluctant to buy European assets simply because the marketplace is in trouble. Pressured to hammer out a strategy for 1992, they recognize that direct investment is an obvious toehold in the European market. But they don't want to risk a cash stake in an acquisition that may not make strategic sense. Yet all around them, the Europeans are restructuring in major groups that are more competitive.

Thomson-CSF's Denis Verret: The company's strategy is to present Thomson-CSF as a single-minded, focused defense firm

Signs of restructuring

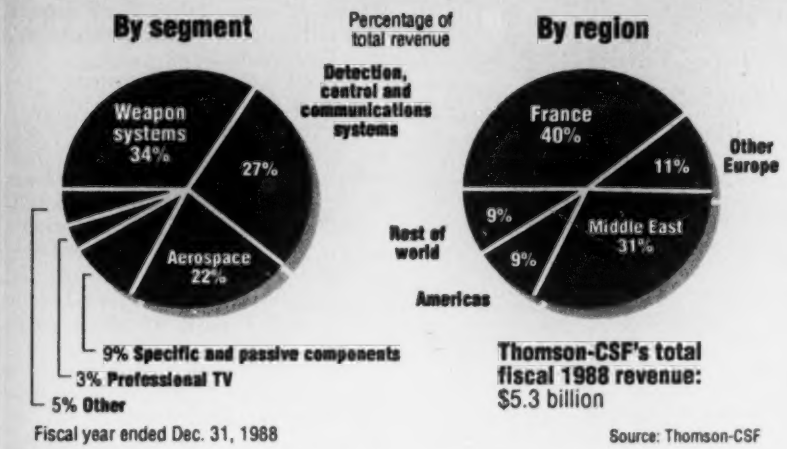
In October, West Germany's Siemens AG and Britain's General Electric Co. completed the heralded takeover of Plessey Co. plc. N.V. Philips GL is shedding its defense operations. Britain's Thorn EMI plc and Racal plc announced plans to seek joint ventures or ownership of defense projects. West Germany's Daimler-Benz AG is planning the takeover of Messerschmitt-Boelkow-Blohm GmbH, and Bodenseewerk Geraetetechnik GmbH (BGT) was sold in September by Perkin-Elmer Corp. to Diehl GmbH & Co. By Thomson-CSF's estimates, 25% to 30% of revenue in the European defense electronics industry will have changed hands this year either through acquisition or alliance.

Restructuring is most acute in Britain, and there's no end in sight. A Racal spokesman declined comment on the reorganization, unwilling to predict the outcome. The excuse: "The British defense industry has been turned on its head. It's too early to tell. It's just a total state of flux."

Thomson-CSF itself has restructured recently. As a result, earnings slipped 7.6% in the first half of this year to about $234 million. Profits fell because of the transfer of assets to a joint venture with Aerospatiale, the state aircraft and missile builder, and the sale of two operations.

With its acquisitions, Thomson-CSF is emerging as a central figure

Thomson-CSF's defense empire



Fiscal year ended Dec. 31, 1988

Source: Thomson-CSF

in the reorganization of Europe's defense electronics industry. It first snapped up Philips' defense assets: Hollandse Signaalkapparaten B.V., or HSA, in Holland; MBLE in Belgium, and Telecommunications Radioelectrique & Telephoniques SA, or TRT, in France, in which Philips had a 49% interest. The divisions have total annual sales of about $605.9 million.

The deals with Philips give Thomson-CSF direct ownership of defense operations in The Netherlands, which will enhance its access to the low country markets of Holland and Belgium, according to Piers Whitehead, defense analyst with Robert Fleming Securities Ltd. He values the purchase price of the deals at up to $400 million, and adds that both HSA and TRT are valuable additions to the company's technology.

In mid-October, Thomson-CSF surprised no one when it jointly announced with British Aerospace plc its interest in acquiring beleagured Ferranti International Signal plc, the British electronics concern caught in a $115.6 million fraud scandal when a subsidiary fabricated the existence of certain defense contracts. Thomson-CSF had been seeking closer links in England to British Aerospace; it is supplying an active radar seeker system for that company's new medium range air-to-air missile, called the Active Sky Flash.

Thomson-CSF and British Aerospace also proposed a merger of their missile divisions in the form of a 50-50 joint venture. Called Eurodynamics, the venture would be the largest European prime contractor of guided weapons systems, with projected sales of $22.4 million.

Cost-cutting measures

Well before its acquisitions, Thomson-CSF was the No. 2-ranked defense electronics company worldwide, after GM Hughes Electronics Corp. Europe's largest defense manufacturer, Thomson-CSF is 60% state owned, with its remaining shares traded on the Paris Bourse. About 92% of its 1988 revenue of $5.3 billion was derived from defense electronics.

Thomson-CSF is harvesting a European defense electronics industry that's in a state of budget-tightening upheaval

The company is led by Alain Gomez, a former left-wing member of the Socialist party who is now demonstrating more conservative leanings. He is an assertive CEO of both Thomson-CSF and its parent company, state-owned Thomson SA, which had 103,700 employees worldwide last year. In 1982, Gomez roamed through Thomson, cutting out money-losing operations at the electronics conglomerate that had 1988 sales of $11.8 billion.

Between 1982 and 1988, Gomez sold off most of Thomson's telecommunications, cable and medical and scientific instrumentation operations. The CEO's most daring move was making Thomson a major consumer electronics firm through the acquisition of General Electric Co.'s RCA Corp. television operations in the United States for a reported $800 million in cash and Thomson's medical electronics group.

An old school buddy of French defense minister Jean Pierre Chevènement, Gomez has attracted to Thomson-CSF young and aggressive executives eager to forge the company into a pan-European defense giant. Already, its international sales are 60% of total revenue, with 9% from the United States.

One of those hopefuls is vice president Denis Verret, 39 years old, the third-ranked executive in the international division. Like Gomez, Verret is a graduate of France's prestigious school for civil servants, the Ecole Nationale d'Administration, and the Harvard Business School. Verret admits that Thomson-CSF's new aggressiveness is still hard for some French politicians to swallow.

"Some of the traditional administration is used to having [defense] as a pure national closed environment," he says. "The new air of Europe is new for them. For them, Thomson is disturbing."

Thomson-CSF's size and diversity also worries some U.S. competitors. "Thomson is a formidable competitor. They do everything. It's well managed, and it's aggressive," says one Europe-based executive with a U.S. defense contractor.

Those same attributes make the French company a very attractive partner for firms seeking a toehold in the European defense market. Since last September's Le Bourguet, the Paris air show, Thomson-CSF has been swamped with deal offers from unidentified U.S. contractors; "Just name all of the top ones and the answer is yes," says a coy James D. Bell, chairman and president of Thomson-CSF Inc., the U.S. subsidiary in Arlington, Va.

The offers are varied: Some chief executives have just asked to sit

Top defense electronics companies worldwide

Source: Thomson-CSF

down and talk to Gomez. Bell says others have analyzed the market share controlled by the respective partners, the benefits of pooling technology and of a strategic alliance. Still others, having merely assigned a vice president to determine a "Europe 1992 strategy," eargerly have sought Bell's advice on the European market.

Thomson-CSF already has a strong U.S. presence. Its Rita contract, a battlefield communication system which Thomson-CSF supplies to the U.S. Army in conjunction with GTE Corp., was awarded in 1985 and is worth $4.3 billion to both companies. Thomson-CSF also teamed up with U.S.-based Raytheon Co. to develop a portion of the U.S. Navy's SQQ-32 minehunting sonar. With Rockwell International Corp. and Singer Co., it is developing submarine combat systems for the Australian Navy.

Other Thomson-CSF projects include a U.S. Army contract for tank simulators and precision landing radars. In June, the U.S. Army contracted to evaluate use of Thomson-CSF's Romeo radar in helicopters. With Texas Instruments, Inc. Thomson-CSF agreed to develop and manufacture helicopter obstacle avoidance systems based on Romeo.

So far, Thomson-CSF "isn't working the U.S. market really hard," says Bell. "There are discussions. There are specific agreements being made [in the United States], but so far, Europe comes first."

And with good reason. Sales to Saudi Arabia once contributed 31% of revenue, but that market is threatened by strong inroads by the British. After being trounced in the Middle East by companies such as British Aerospace, Thomson-CSF repositioned itself as a major supplier to NATO countries. With the declining Middle East market, "consequently, we have to push ourselves in the United States and European markets," vice president Verret notes.

Thomson-CSF is a very attractive partner for firms seeking a toehold in the European defense market

On European soil, Thomson-CSF threatens U.S. defense contractors on several fronts. After it consolidates merged operations, savings in research and development, currently funded at 20% of revenue, should be "very substantial," estimates Verret. "Any percentage of 20% will have a direct impact on results."

U.S. firms may lose

Meanwhile, an already diversified Thomson-CSF is emerging as a market leader in technologies such as radar and sonar. The company's strategy is to market that broad expertise, presenting Thomson-CSF as a single-minded, focused defense firm. The tactic is gaining in popularity, employed also by Plessey/Siemens and British Aerospace. As these companies diversify through cross-border mergers, others will disappear.

"Unless individual European governments take it upon themselves to interfere with the progression of market forces, I cannot see more than three or four major European players in the European defense equipment industry by the mid-1990s. I believe we are likely to experience some major cross frontier amalgamations and mergers," predicted Roland Smith, chairman of British Aerospace, in an October speech.

U.S. defense firms may lose market share to these pan-European giants, says Plessey's Teed. "There must be an element of that. Grouping together, [Europeans] will inevitably be more competitive."

European governments have proved their willingness to choose the most competitive solution, despite its national origin. But the old gripe against state-owned defense firms lingers. As one U.S. defense contractor complains about Thomson-CSF, "Their marketeers are the French premier, the French president and the French defense minister."

Yet U.S. firms are increasingly concerned over the activities of the Independent European Programme Group (IEPG), the organization charged with opening markets to competition so that contracts can be placed anywhere in the European Economic Community. It is gaining more power, and to some Americans, it appears that the IEPG is developing a "buy European" bias. That would expedite any move toward pan-European defense standards, as would industry consolidation. With standardization, a Belgian pilot would ideally be able to operate, for example, an Italian jet.

With so many bits of European defense firms up for grabs, why haven't more contractors from the United States shown interest? Some looked at Ferranti, including Martin Marietta Corp., Westinghouse Electric Corp., and GE, but, as Verret suggests, "I have a feeling some American companies are skeptical about the freedom they will have to make big investments in Europe."

[Conversion rates: 6.4 French francs = $1; 1.6 pounds = $1]

Volatile hard drive arena picking up the pieces

After a price war and a capital drought, this maturing industry is trying to rebound from last year's troubles. The strong are getting stronger and the weak scrambling for cash

BY JOHN McCREADIE

Only 12 months ago disk-drive maker Seagate Technology Inc. shocked the industry by announcing it had lost a staggering $52.8 million during its first quarter in fiscal year 1988, ended September 30. Now, as it tries to absorb newly acquired Imprimis Technology Inc., Seagate has again surprised the rigid disk drive industry — this time with a 25% increase in revenue growth, accounting for a healthy $23.4 million in net income during the comparable quarter this year.

Seagate's performance is just one indicator of the intense volatility of the disk-drive market. The $7 billion industry has been beset by a series of problems over recent months. They have included overproduction, price wars, uncertainty brought on by the shift from 5.25-inch to 3.5-inch drives, difficulties in securing financing, and takeovers — to say nothing of fierce competition, especially as giants IBM and Hewlett-Packard Co. move more heavily into the merchant market.

Some companies have been able to rebound and prosper by taking advantage of weaker competitors, while others are still struggling.

"I've never seen a rate of change in any industry as fast as in the Winchester drive market," laments Stuart P. Mabon, president of drive maker Micropolis Corp. in Chatsworth, Calif. His company, which last year reportedly lost $300 for each 5.25-inch 380MB drive it shipped, reported losses of $23.7 million during its third quarter of fiscal 1989, ended September 30, with revenue for the same period of $66.5 million. The company's losses for the nine months ending in September totaled $57.6 million.

For those drive makers who manage to survive during the next year, the prospects look brighter as demand is projected to be strong. Analysts are predicting annual revenue growth of 10% to 22% for 1990, and slightly more for hot-growth 3.5-inch drives with capacities in the 100MB to 200MB range.

Although forecasts for computer systems' demand remain modest — the high-volume U.S. personal computer market will show only a meek 9% growth, from 10.9 million units in 1989 to 11.9 million in 1990, according to market researcher Dataquest Inc. — end user storage appetites are growing. Observes Michael K. Yam, storage product manager for Apple Computer Inc., in Cupertino, Calif., for example, "Most Macintosh [disk-drive] capacities have doubled over the last year."

Worldwide OEM rigid-disk-drive shipment revenue will total $5.8 bil-

Top worldwide merchant and captive disk drive manufacturers

lion this year, up 16% from last year's $5 billion, says Jim Porter, president of Disk/Trend Inc., a company that monitors the disk-drive industry. He is further forecasting a strong 22% worldwide growth in 1990, as shipment revenue grows to $7 billion.

Last year's problems in the industry arose from unrealistically optimistic market projections, especially in forecasts for high-end drives. Consequently, many drive companies became overzealous about increasing their manufacturing capacities. As the supply mounted, several price wars developed, especially around 380MB and 760MB drives.

Executives, meanwhile, expect that pricing pressures will remain a constant in the industry for some time. "The classic 380MB pricing pressure subsided some months back," says Maxtor Corp. president and CEO George M. Scalise, "but the 760MB is seeing more pressure as more people try to get into that market." San Jose-based Maxtor, which reported strong net earnings of $4.8 million in the second quarter of fiscal 1990, ended September 24, on revenue of $117.1 million, has a 61% market share of 760MB drives. It has been a proponent of "aggressive yet responsible" pricing in the industry.

"It's a low-profit business, and you have to be prepared for that," says William J. Almon, president and chief operating officer of 3.5-inch-drive maker Conner Peripherals Inc., based in San Jose. And it doesn't appear industry margins will be changing. Says Dataquest analyst Phil Devin, "We will never see better than [an industry average of] 20% gross margins."

Weaker companies find themselves wishing for some relief from the pressure to lower prices. "Hopefully, the industry will get smarter about pricing so they don't hurt themselves," asserts Gerard F. Hallaren, strategic planning director for drive maker MiniScribe Corp. in Longmont, Colo., a direct Seagate competitor. MiniScribe was one of the year's biggest casualties: the company's board of directors discovered that the executive team was falsifying inventory records to pump up its financial picture. New management is now trying to bring the company back by focusing on 3.5-inch drives.

Another challenge for drive makers has been to develop strategies that take into account the shift from the once-dominant 5.25-inch drives to the sturdier and handier 3.5-inch devices. Although they were the first to realize the shift to smaller drives, both Quantum Corp. and Rodime plc stumbled making the transition.

Quantum suffered $17 million in write-offs after canceling its 5.25-inch line. Combined with a late product rollout, the Milpitas, California-based company experienced a decrease in net income of 57% from 1986 to 1987 and a net profit loss of more than $3 million in fiscal 1988. Today, Quantum is applauded for its high gross margins of 27%, according to analysts, which exceed the industry average of about 20%.

"I've never seen a rate of change in any industry as fast as in the Winchester drive market"

Stuart Mabon, Micropolis president

Scotland's Rodime, the only independent drive manufacturer based in Europe, took more of a jolt in switching to 3.5-inch. Like many drive makers, the company announced operating losses of $8.8 million and $7.6 million in the second and third quarters of fiscal 1989, respectively. The company got caught with cash tied up in 3.5-inch R&D, and price wars prevented it from selling its 5.25-inch drives at much of a profit.

Another casualty of the rapid pace of the 3.5-inch drive segment is Priam Corp. of San Jose, which filed for Chapter 11 protection from its creditors under the U.S. Bankruptcy Code at the end of October. The company is abandoning its 5.25-inch 760MB drive to concentrate on its development of a leading-edge, 3.5-inch drive with a capacity of 400MB. In fiscal 1989, ended June 30, the company reported a $25.4 million loss, on top of substantial previous year losses.

Meanwhile, beleaguered Micropolis is embarking on a risky counterstrategy regarding 3.5-inch drives. Several months ago the company announced it was aborting its 3.5-inch product line, at least for the present, to focus entirely on 5.25-inch products.

Analysts take a dim view of this move, since the industry's highest growth is in 3.5-inch drives. The 5.25-inch market will decrease by 17% between 1989 and 1994, while the 3.5-inch will grow by 23%, Dataquest predicts. That trend will continue indefinitely, as 3.5-inch drive capacities go ever higher.

Micropolis' saving grace, however, is its strong customer base, which includes Sun Microsystems Inc. and Unisys Corp.

Drive manufacturers are also seeing more competition as two large captive-drive makers — IBM and Hewlett-Packard — aggressively stalk the merchant OEM drive market.

IBM entered into an agreement to supply a cutting-edge 320MB 3.5-inch drive — a product nearly 12 months ahead of its competition, analysts say — to Western Digital Corp. of Irvine, Calif. Through Western Digital's extensive OEM customer base, IBM is attempting to steal market share from the nimble independents that have always dominated this market.

"There are 25 major OEMs around the world evaluating the drive," says Western Digital's Richard E. Rutledge, marketing manager for the company's storage management division. Currently, IBM has less than 1% of the merchant market share, reports David P. Vellante, an analyst at market research firm International Data Corp. (IDC), of Framingham, Mass.

That share will likely remain small because OEMs do not want to buy system components from such a formidable competitor, industry watchers predict. "Most view IBM as a competitor rather than a supplier," Micropolis' Mabon says. "As long as third-party independent manufacturers remain strong, there's no reason for competitors to buy from [IBM]."

But DEC's Irv M. Lyles, marketing manager for the storage and information management group, Maynard, Mass., says he would not rule out the idea of evaluating the IBM product, despite IBM being DEC's biggest competitor.

Hewlett-Packard is attacking the OEM market with perhaps even more vigor. In addition to offering an aggressive warranty, HP recently separated out its captive-storage division

from its OEM manufacturing group. The two are so separate now that the OEM division has to compete for HP business through the same evaluation process as outside competitors do.

Based in Boise, Idaho, the new Disk Mechanism Division will be dedicated to high-volume orders and low-cost manufacturing of 3.5- and 5.25-inch drives. "Our intent is to continually expand our OEM market share profitably," says Donald L. Curtis, general manager of the OEM division, also in Boise. Currently, HP has about a 5% market share in the 380MB and 760MB noncaptive market, says IDC's Vellante.

Letting go of once-proprietary company drives has not been easy for HP system design engineers, however. "They had to come to terms that their HP jewels were going to be sold into the merchant market," Curtis says.

One way HP is upping the ante is by offering a unique, five-year manufacturer's warranty for OEM mechanisms based on a mean-time-between-failure rate of 150,000 hours, the highest in the industry. HP contends the aggressive warranty merely reflects product reliability and is not a strategy to gain market share.

But competitors see HP's strategy differently. "They're simply looking for an angle to make themselves more attractive to a customer," says Tim Mahoney, vice president and director of sales and marketing of Rodime Inc., Rodime's U.S. subsidiary in based Boca Raton, Fla.

Many critics believe extended warranties are not at the top of the OEM customer's list, anyway. "Experienced system manufacturers don't care about warranties as much as they do about quality," says Bob Oakley, director of sales and marketing for Microscience International Corp., based in Sunnyvale, Calif. Adds Apple's Yam, "We wouldn't walk away from a vendor who offers an [extended] warranty, but we don't look at the warranty up front. That's more of a contract issue."

While most drive makers claim they have no plans to increase current warranties, which average about one year, a few will follow HP's lead.

Micropolis offers a one-year warranty with an option for the customer to purchase an extended five-year warranty. Fujitsu America Inc. is seeking to outdo HP's warranty, although the details have yet to be worked out, says Michael J. Gluck, senior vice president for Fujitsu's computer products group.

As a result of industry woes, companies that need capital to gear up their product lines are finding sources are drying up. "After Seagate's losses, raising capital in the United States became difficult," says Rodime's Mahoney. "We were forced to live on our own cash that we generated." Rodime has since secured $41 million in financing from the Bank of Scotland and another British investor.

Worldwide OEM rigid-disk-drive shipment revenue will total $5.8 billion this year, up 16% from last year

This added complication will put strains on cash-seeking companies attempting to finance company turnarounds. "A lot of clients are not willing to talk about disk-drive investments because they have been burned before," says financial analyst Doug van Dorsten for Shearson Lehman Hutton Inc.

Meanwhile, says IDC's Vellante, "The industry's in the middle of a shakeout." While 69 companies make 733 different models of hard-disk drives, according to Dataquest, the top 10 companies account for more than 80% of industry market share. Strong, cash-healthy companies are in a good position to buy the numerous companies whose financial pictures are fragile.

Evidence of the shakeout is Seagate's acquisition of high-end drive maker Imprimis, a Control Data Corp. subsidiary. As a result of the $450 million deal completed October 2, Seagate now offers an impressively broader product line — ranging from low-end 3.5-inch to high-end 8-inch drives — and expanded distribution channels, especially to large original equipment manufacturer accounts. Considered a bargain by many analysts, the purchase rendered Seagate a $2.5 billion disk-drive company.

As a result of the broader product scope, analyst van Dorsten speculates that OEMs will now find Seagate a more attractive supplier, forcing other drive companies to broaden their product offerings through acquisition or joint venture, or perhaps to become even more niche-oriented.

In addition, consolidation has created a buyer's market for drive companies, fueling rumors of potential company acquisitions — such as Conner Peripherals' rumored purchase of Micropolis. Conner Peripherals, one of the fastest-growing companies ever, is in fact well situated to acquire. Analysts predict its revenue will more than double, to nearly $700 million, this year.

Both Conner Peripherals and MiniScribe have made bids for thin-film media maker Domain Technology Inc., in Milpitas, Calif., one of the worst-off of all drive-component vendors. Ironically, most of Domain's woes were a result of MiniScribe's inability to pay its bills. With MiniScribe accounting for about 57% of its business, Domain was strapped for cash and filed for Chapter 11 protection last June.

As the industry consolidates, many customers will likely be reevaluating whom they do business with — perhaps providing opportunities for some nontraditional merchant drive suppliers, both foreign and domestic.

Japanese drive makers, cash rich and vertically integrated, are in a good position to prosper as the industry consolidates. "Customers want suppliers that are going to be around for the long term," says Fujitsu's Gluck. Although declining to give specific numbers, Gluck claims Fujitsu's drive business has increased substantially, speculating that "customers must be nervous" dealing with some U.S. drive companies.

"The customer base has serious concerns about the condition of many companies in the industry," agrees Conner Peripherals' CEO and chairman Finis F. Conner.

Data General Corp., a systems manufacturer in Westboro, Mass., however, is not worried about getting a steady supply of drives, despite the disruption in the industry. In fact, John Hartjen, manager of mass storage products, believes industry consolidation is healthy: "It's making stronger companies out of companies that haven't been as strong." □

Image-processing vendors gear up for fast growth

With workstation and personal computer makers showing increasing interest, image processing is primed to become an integrated part of standard computing platforms

BY TAMMI HARBERT

The next few years may prove to be a period of fast — and sometimes painful — growth for image-processing board vendors as their business attracts the attention of workstation and personal-computer manufacturers. Image processing is destined to follow in the footstep of graphics, analysts say, and become an integrated part of standard computing platforms.

Among the forces driving image processing onto standard platforms are increasing standardization of workstations; plummeting hardware costs; and rapid advances in processing speeds, system bandwidths and memory capacity.

"Within two to three years," predicts Richard D. Schwarz, first vice president at Shearson Lehman Hutton Inc., "imaging will become part of workstations and high-end personal computers." Systems integrators keying off standard platforms represent the future of the electronic imaging market, Schwarz says. And board-level suppliers, mostly small, privately held companies, have a key role in supplying these integrators with image-processing boards, packaged subsystems, and software, he adds.

Analysts, however, are quick to assess the difference between image processing and graphics. In image processing, an image is imported from the real world into a computer, then usually manipulated. In graphics, the computer creates its own images based on models generated by equations that it processes.

Because of the difficulty in defining the market for image processing, it is equally difficult to quantify, Schwarz says. Because the market consists of hundreds of application-specific niches and the applications are endless, he says, "It's hard to imagine an area of science and technology that is going to be as ubiquitous as this one."

Clyde Spencer, senior industry analyst for graphics and imaging at Dataquest Inc., San Jose, says revenue from image-processing hardware components (excluding host computers, workstations and peripherals) amounted to slightly more than $1 billion in 1988, a high figure, according to many in the industry.

Spencer divides the imaging industry into seven application markets: geographic information systems; geophysical and seismic imaging; remote sensing; high-end color electronic prepress; industrial inspection and machine vision; medical diagnostic imaging; and a miscellaneous grouping. This last grouping includes applications that may become commercial products but are now in the research and development stage and small industries such as scientific visualization. These miscellaneous applications are dominated by personal-computer-level boards, Spencer notes, and he predicts that this area will see the highest growth in the next four years.

Analyst Leonard Yencharis, a senior partner with Yencharis Consulting Group in North Massapequa, N.Y., puts the 1988 worldwide market for image-processing hardware and software at a considerably more conservative $400 million. He sees that market growing to $908 million in 1993, adding

Robert I. Birenbaum of Imaging Technology: The signs are all there for the image-processing field to take off

that the majority of image processing at that time will be done on workstations and PCs.

Board-level companies earned $80 million in 1988, says Yencharis. Major board-level companies with their market share include Imaging Technology Inc., 17%; Datacube Inc., 17%; Matrox Electronic Systems Ltd., 15%; Cognex Corp., 13%; and Data Translation Inc., 9%. The rest of the market is made up of very small companies.

The future growth of these companies may depend on how successfully they sell into the workstation platforms. "Virtually all of the board-level companies are trying to attach themselves to workstation vendors," says Yencharis.

Last spring, Visual Information Technologies Inc. (VITec) of Plano, Texas, primarily a military market vendor, moved in that direction when it signed two major OEM deals with workstation vendors Ardent Computer, Sunnyvale, Calif., and Megatek Corp., San Diego. Under the agreement, Ardent, which has been in the process of a merger with Stellar Computer Inc. of Newton, Mass., to form Stardent Inc., will purchase custom high-end image computing components from VITec for integration into its Titan graphics supercomputer. The two also have jointly developed a graphics/imaging workstation that is being marketed to defense mission planners.

Some relationships will inevitably go beyond sales agreements, say analysts. Sun Microsystems Inc., for example, bought an image-processing board maker called Transcept Systems in 1987 and now sells the two-board TAAC (Transcept Applications Accelerator) packaged in a Sun workstation.

Sun actively involved

Sun is the only workstation vendor that has actively entered the image-processing business, says William K. Pratt, Sun's director for imaging technology. "But I wouldn't be surprised if some other large workstation companies also got into it," he adds. Pratt, who founded one of the first image-processing systems companies, Vicom Systems Inc., in 1981, is considered one of the gurus of image processing.

Workstation vendors are not the only large companies becoming interested in image processing. Companies involved in analog chemistry-based technology for imaging — typically, photography and photographic processes — like Eastman Kodak Co. and E.I. du Pont de Nemours & Co., are also involved. In fact, Du Pont last year bought over 60% of Benchmark Technologies Ltd., an image-processing board company in England, and renamed it Du Pont Pixel Systems, notes Yencharis. "They are setting up to compete with the board companies," he says.

Vendors should watch IBM, which has said that in the 1990s electronic imaging will be its biggest area of growth

Toshiba Corp. has also entered the image-processing board market. Toshiba's most recent image-processing board runs on the IBM PC, PC AT and PC XT. Leonard J. Feldman, director for product marketing for advanced systems at Toshiba America Inc./Information Systems Division, believes that the image processor will become embedded into workstations and personal computers by 1991 or 1992.

Feldman predicts that the current level of functionality on PC add-in boards will be taken over by software, while a large degree of the current level of functionality provided by VME boards will then be provided by the PC board. Box-level companies, he says, will only be important for providing specialized systems with high performance in application areas where customers are willing to pay a high price.

And vendors should always keep a close eye on on Big Blue. IBM has said that in the 1990s, electronic imaging will be its biggest growth area. The company has established a Department of Image Technologies within the IBM Research Division, and a Publishing Systems Business Unit, chartered to bring electronics systems to printing markets.

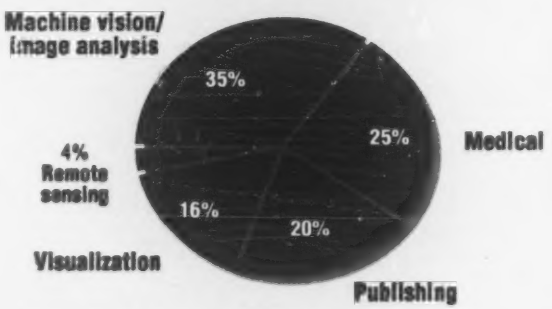
The challenge to board companies in such an atmosphere, says Wayne Threatt, cofounder and vice president for sales and marketing at Androx Corp. of Canton, Mass., is to integrate their special hardware and software capabilities into standard computer platforms. For the next three to five years, he believes, workstations still won't have enough processing power to perform interactive image processing — for that, a computer would have to achieve 100 MIPS to 200 MIPS. So computer and workstation vendors will have to carefully integrate specialized image-processing boards and software within their systems.

Strategic partnerships between the smaller board vendors and some of the larger firms looking to get into the business may be the most efficient way for both small and large companies to take part in the growing industry.

Although vendors are building boards to run on standard buses, such as VMEbus and the ATbus, the industry still faces a barrier in the form of proprietary software. "It's a

1988 image processing market

Worldwide market for image-processing hardware and software



Total 1988 market: $400 million

Source: Yencharis Consulting Group

When business goes south, decisions go north.

real problem," says Spencer. "Every time new hardware comes out, everyone ends up rewriting the code."

But both hardware and software companies are trying to change that situation. Sun is proposing a common software interface — called Virtual Processor Interface — as an ANSI standard, said Pratt at Shearson Lehman Hutton's Electronic Imaging Forum VII in January. Pratt says Sun is currently working in committee to define the software standard. Such an interface would make applications software easily portable.

Regardless of who sets the standard, with the advent of powerful standard hardware, independent software developers are bound to start creating and marketing image-processing software. This software can be recompiled and run on a variety of hardware platforms, maintains John Montelione, president of Paragon Imaging Inc., Lowell, Mass., one such software development company. With both hardware and software

Strategic partnerships are enticing both small and large vendors

coming in standard building blocks, he says, there will be a shift in the customer base to *Fortune* 500 companies. And, he predicts, "systems integrators will disappear."

The value that systems integrators have been adding will no longer be valuable, he explains, because the *Fortune* 500 companies will be able to buy standard software to run on their standard platforms to solve their own image-processing needs.

Montelione's view contrasts with those of analysts, like Schwarz, who believes the system integrator is a very important factor in the growth of the image-processing market.

The emergence of knowledgeable systems integrators, the entry of software developers writing image-processing applications, and the proliferation of the personal-computer platform in imaging all lead Imaging Technology Inc., Woburn, Mass., to believe that business is about to boom, says vice president for marketing Robert I. Birenbaum.

Board companies, meanwhile, are starting third-party vendor programs to get application developers to write packages for their hardware, and systems integrators to use their products. Imaging Technology, for example, has the Vantage program, which consists of about 90 hardware and software products that work with Imaging's hardware. Matrox Electronic Systems Ltd. has Matrox Imaging Partners, with a membership of about 25 companies, according to marketing manager Raymond Snow.

On the hardware side, vendors compete in several areas, says Yencharis: larger frame buffers, more data compression, and techniques for presenting color in images. Many of these functions are being incorporated in application-specific ICs, he says.

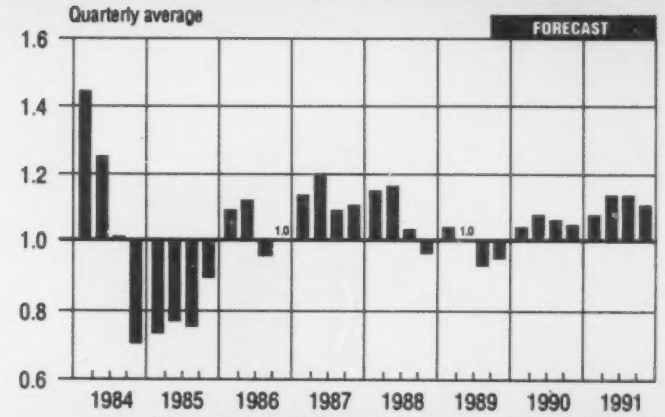
Although everyone in the industry recognizes the beginnings of the integration of image processing into workstations and PCs, observers say that is not the best avenue for all image-processing applications. For example, in real-time applications such as machine vision, one of the markets Imaging Technology concentrates on, you don't need a workstation.

David Schatz, director of marketing for Cognex Corp., Needham, Mass., which specializes in machine vision systems for the electronics and semiconductor industries, points out that his company's products run less danger of being integrated into workstations because they are designed to be standalone computer and vision processors. While the general image-processing boards are being integrated as chipsets into computers and workstations, he says, Cognex will be building a machine vision system that has image processing and general purpose computer capabilities.

Peter Walsh, president of Adaptive Automation, South Windsor, Conn., a systems integrator in the machine vision business, agrees: "The workstation is everybody's favorite prediction for the moment," he says. "But in embedded systems, it's just not relevant."

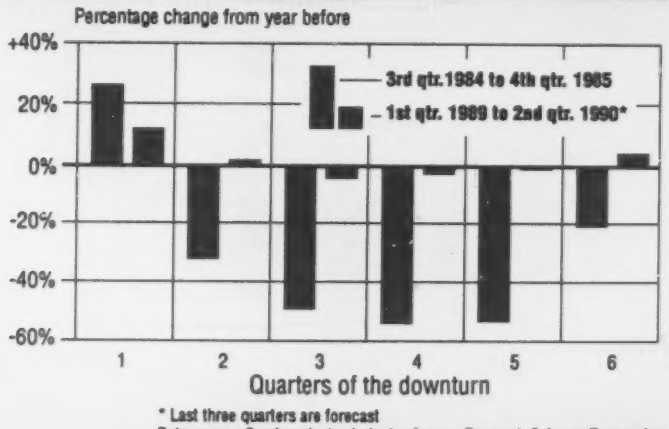
But analysts say the shift of most image processing to standard platforms is inevitable. Although 80% of the image processing last year was done on proprietary systems, estimates Yencharis, 70% of image processing in 1993 will be done on workstations and PCs. □

Semiconductor book-to-bill ratio



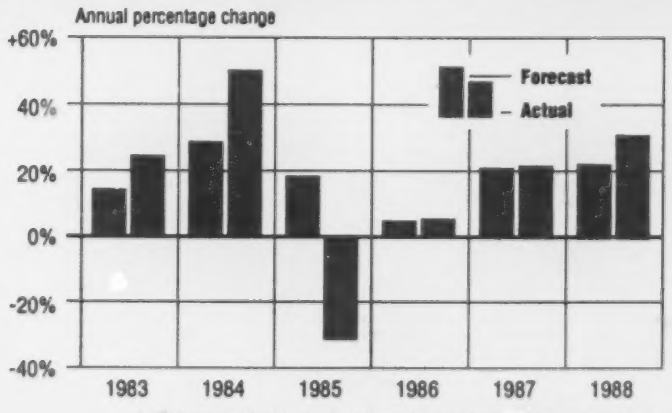
Data source: Semiconductor Industry Assoc.; Forecast: Cahners Economics

Semiconductor bookings in two downturns



* Last three quarters are forecast
Data source: Semiconductor Industry Assoc.; Forecast: Cahners Economics

Semiconductor sales to North America



Data source: Semiconductor Industry Assoc.; Forecast: Cahners Economics

Chicken Little and the semiconductor industry

Alarms are ringing. Layoffs are rampant. Managers are worried. Even the optimistic Semiconductor Industry Association (SIA) is forecasting a decline in U.S. semiconductor sales next year.

What's going on? The U.S. semiconductor book-to-bill ratio is falling, says the SIA. For the fourth consecutive month, the book-to-bill ratio fell in September, to 0.90. That means for every one dollar of sales, only 90 cents worth of new orders were booked in June. The last time the book-to-bill ratio fell to 0.90? September 1984 — just before the traumatic semiconductor industry recession of 1985.

Today's reaction to the falling book-to-bill ratio calls to mind the old adage about Chicken Little. Remember Chicken Little? He thought the sky was falling because he felt an acorn drop on his head.

The book-to-bill ratio has not taken a sudden, unexpected turn for the worse. Growth in bookings relative to billings has been less than robust ever since September 1988. Since that time, bookings have continued to grow, but each month have grown more slowly than the month before. And each month since September 1988, growth in sales has outraced the gains in bookings.

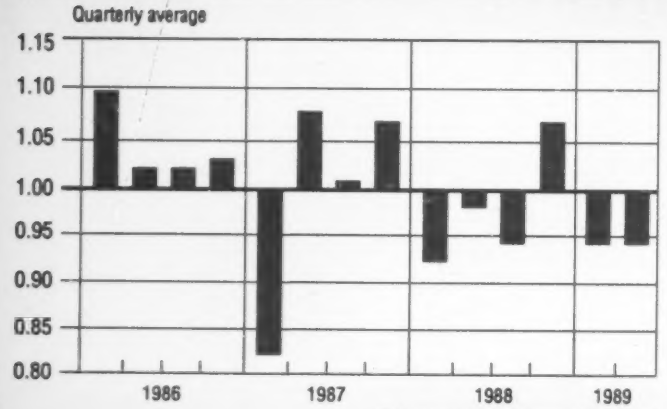
Book-to-bill watchers who analyze the data know that the situation is not a repeat of 1985. The book-to-bill ratio stood at 1.02 in August 1984 and plummeted five months later to 0.65. In comparison, in April 1989 the ratio stood at 1.02 and had dropped only to 0.90 by this past September.

The semiconductor book-to-bill ratio is a bit like Chicken Little's acorn. Because of our last experience in the 1985 recession, a low book-to-bill ratio causes the press, budget planners and industry watchers of all types to sound the alarm. The sky is falling! The sky is falling!

But the sky is not falling. Semiconductor bookings will manage to scrape by with only minor losses this year and early next year, down each quarter by 1% to 5% below year-ago levels. The economic backdrop for today's slowdown is far different from that of 1985, when bookings plunged 20% to 55% each quarter. As the industry quickly turns the corner in 1990, blue skies in 1991 will mean Chicken Little had better get lost — and fast.

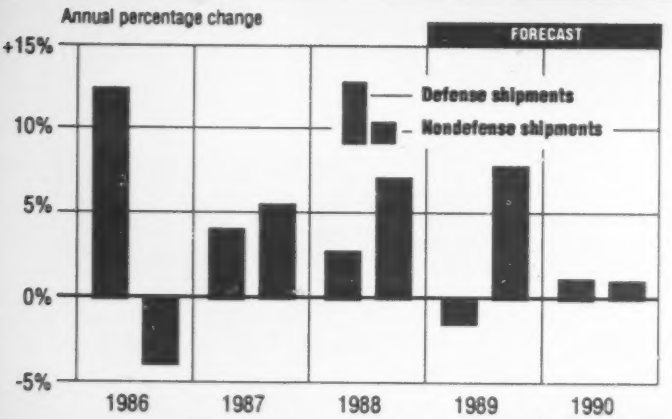
ELIZABETH B. BAATZ

Communication equipment book-to-bill ratio



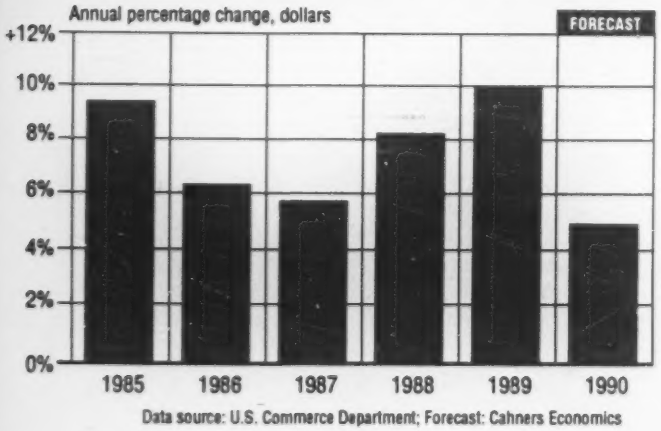
Data source: U.S. Commerce Department

Communication equipment



Data source: U.S. Commerce Department; Forecast: Cahners Economics

Business purchases of communication equipment



Data source: U.S. Commerce Department; Forecast: Cahners Economics

Communication market languishes

During the late summer months, new orders for communication equipment showed their usual monthly volatility, plunging 10.8% from July to August. This precipitous drop brought the total for the 12-month period ending in August to $74.4 billion, just 2.5% ahead of the previous 12-month period. New order growth exhibited neither a clear upward nor downward trend, but instead languished at 1% to 3% annual growth for several months.

Shipments for the industry turned up in the same pickle. In this case, year-over-year shipment growth bumped around from 3% to 4%. Unfortunately, the higher growth in shipments relative to new orders sank the book-to-bill ratio below parity. Since the beginning of 1988, the quarterly average ratio managed to push above 1.0 only in the fourth quarter of 1988. Compare that showing to the 10-year period from 1977 through 1986. During that stretch, the book-to-bill ratio held above 1.0 in every quarter except the first quarter of 1977.

The culprit responsible for the current sluggish growth is none other than the good guy that boosted the market earlier in the decade — namely, the defense communication sector. Shipments for this equipment will drop below year-ago levels this year for the first time since 1975. But the huge backlog, currently at 17 times monthly shipments, means that defense shipments shouldn't fall off the charts completely. Of course, a lot depends on Capitol Hill maneuvering and on which programs get cut.

Right now, the commercial communication equipment market is riding in to save the day, keeping growth in total new orders and shipments from a massacre. Cahners Economics expects shipments growth for this sector to hang close to 7% this year. That gain is on top of the 7% increase recorded in 1988.

Businesses are still buying communication equipment despite the economic slowdown. Business purchases of all types of telecommunication and datacommunication equipment amounted to an annualized $48.3 billion in the second quarter of this year. That spending surged almost 12% from the level of a year ago. Purchases of networks, multiplexers and other communication equipment may increase another 5% in 1990.

MADELINE FRANCHI